X-TARGET- A SIMPLE HEAVY-ION-BEAM-DRIVEN TARGET FOR HEAVY ION FUSION ENERGY

B.G.Logan[1], E. Henestroza[1], L. J. Perkins[2]
[1]*Lawrence Berkeley National Laboratory, Berkeley, CA, USA*
[2]*, Lawrence Livermore National Laboratory, Livermore, CA, USA*

One-sided axial target illumination has been explored using annular and solid-profile heavy ion beams with range 1.3 g/cm^2 to compress and ignite deuterium-tritium fuel filling the volume of metal cases with cross sections in the shape of an "X" (X-target). The HYDRA radiation-hydrodynamics code [M. M. Marinak *et al.*, Phys. Plasmas **8**, 2275, 2001] was used in 2-D to find quasi-spherical fuel compression of the fuel toward the X-vertex on axis by controlling the geometry of the case, the successive timing, power, and radii of three nested annuli of ion beams for compression [E. Henestroza, et. al." *Phys. Plasmas*, **18**, 032702 (2011)]. Hydro effects of those beams penetrating and heating the case as well as the fuel is included. The case is important for tamping, and expansion of the case can be manipulated to improve the quasi-spherical symmetry of initial fuel compression. Turning off radiation shows that radiation drive is unimportant to the fuel compression compared to hydro. At low fuel densities of 150 x solid density, (convergence ratios of < 5-7), Rayleigh–Taylor instability mix is found to have a minor impact slightly degrading ignition and subsequent fuel burn-up.

Recent work to be reported shows any ions of the same range (e.g., 60GeV U, 26 GeV Cs, or 13 GeV Rb) can be used. Calculations taking into account heavy ion beam transverse and parallel emittance growth show that such ion beams can be drift compressed to 200 ps and focused into plasma-neutralized chambers to r_{spot}<200 microns for fast ignition of the compressed DT near the vertex of the X-target. Scaled compression focusing physics experiments related to the X-target are planned using the NDCX-II accelerator slated to become operational 2012. With 3 MJ for fuel compression and 3 MJ for fast ignition, initial X-target gains of 40 are found sufficient for $\eta_d G$>10 using efficient heavy ion accelerators. Plans to further optimize X-target design in a variety of ways will be discussed.

Simple X-target construction of an extruded metal case filled with DT and hard frozen (no beta-layering needed), should be conducive to low cost, low precision, mass manufacture. The rigidity of the filled X-target case tolerating extremely high gyroscopic spin frequencies (g_w~107 g), and tolerance for residual offset and tilt errors, should facilitate target injection into hot gas chambers and alignment of its axis with driver beam annuli.

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